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THE BEGINNINGS OF HUMAN HISTORY READ FROM THE GEOLOGICAL RECORD: THE EMERGENCE OF MAN¹

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PLEISTOCENE STAGES IN HUMAN HISTORY SUBSEQUENT TO THE TIME OF HEIDELBERG MAN. III.

THE earliest remains of man, known in the *Pithecanthropus* of Java and the Heidelberg type, are generally considered to represent stages of time not ranging far from the beginning of the Pleistocene period, or the geological division immediately preceding the present. It has been suggested that *Pithecanthropus* is of Pliocene age. The Heidelberg jaw was considered by Schoetensack to be possibly Pliocene, but is presumably not older than early or middle Pleistocene. With the exception of these two cases, the numerous occurrences of human remains found in deposits antedating the beginning of the present geological period are all generally considered to be of middle to late Pleistocene age.

Excepting a few widely scattered occurrences, ranging from Australia through Asia and Africa, the collections representing Pleistocene man have been secured from formations of western Europe, and discussion of the next stages in human history is as yet mainly concerned with early man in Europe. This record fortunately occurs in a division of the geological story to which extraordinarily close attention has been given by reason of the interesting fluctuations of climate marking this portion of time. Before proceeding with a discussion of the occurrences of human remains and the nature of the evolutionary sequence, it is desirable to sketch in a preliminary way an outline of the climatic and geographic history of this period, in

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<i>Geological Periods</i>	<i>Climatic Stages</i>	<i>Cultural Stages</i>	<i>Human Types</i>
<i>Recent</i>	<i>Postglacial</i>	<i>Age of Metals</i>	<i>Modern Races</i>
<i>Pleistocene</i>	<i>4. Glacial</i>	<i>Palaeolithic</i> <i>Neolithic</i> <i>(Azilian</i> <i>Magdalenian</i> <i>Solutrean</i> <i>Aurignacian</i> <i>Mousterian</i> <i>Acheulean</i> <i>Chellean</i>	<i>Cro-Magnon</i>
	<i>Interglacial</i>		<i>Neanderthal</i>
	<i>3. Glacial</i>		<i>Heidelberg</i>
	<i>Interglacial</i>		
	<i>2. Glacial</i>		
	<i>Interglacial</i>		
	<i>1. Glacial</i>		
<i>Pliocene</i>		<i>Eolithic</i>	<i>Pithecanthropus</i>

FIG. 1. TABLE ILLUSTRATING RELATION OF STAGES IN HUMAN EVOLUTION TO DIVISIONS OF GEOLOGICAL TIME.

which we find man passing through some of the most significant stages in the whole course of his evolution.

FLUCTUATIONS IN ENVIRONMENT OF PLEISTOCENE MAN IN EUROPE

The story of glacial history in Europe corresponds closely with that of America, and is too well known to require more than the general statement that during at least four stages in this epoch, climatic conditions were of such a nature that accumulation of snow and ice in enormous quantities was permitted at altitudes far below the present snow line. The extent to which the climate differed from that of the present time varied for the several glacial stages, but in the most extreme advance ice seems practically to have covered the northern half of Europe, extending over the British Isles and across the continent through Belgium, Germany and Russia. Ice also reached down from the Alps and other ranges to levels much below those at present touched by glaciers. Between the ice epochs, the

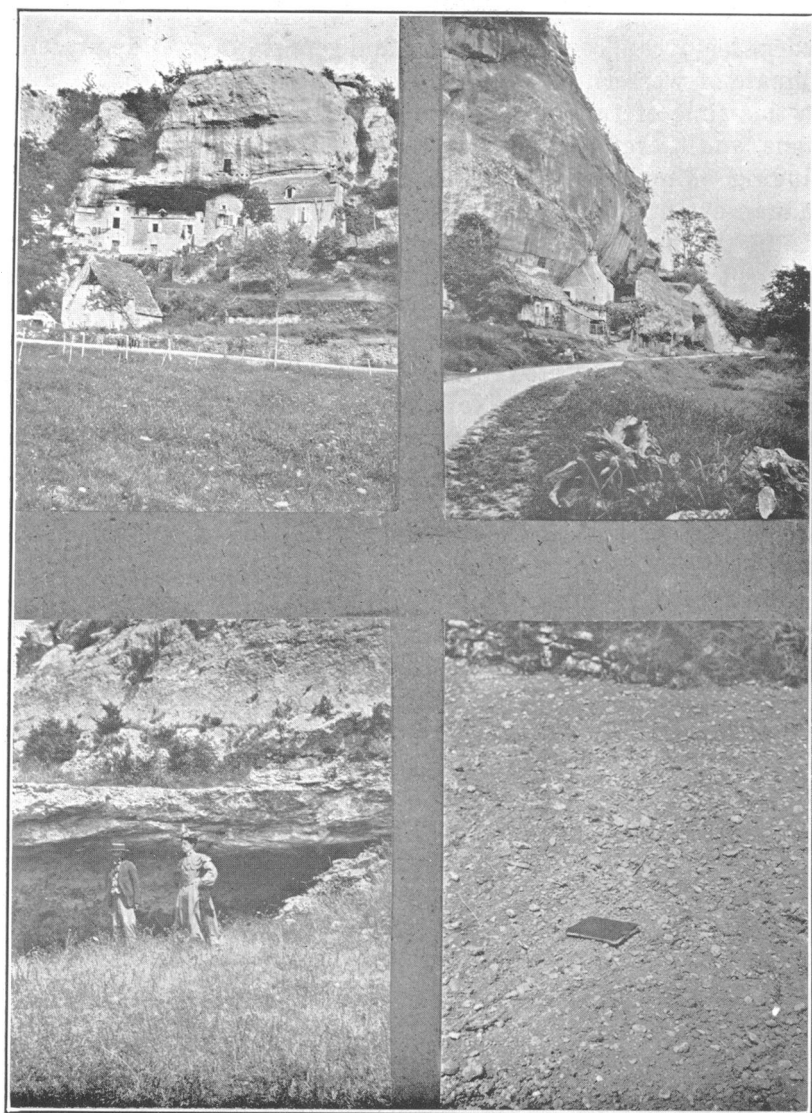
climatic pendulum, swinging in the return beat, brought conditions in some cases more closely approaching those of the warm temperate regions than we find represented in the present climate of western Europe. It is important to note that it was in this time of frequent and radical changes in climatic conditions, and therefore of variation in the whole environment, including animal and plant life, that the present high level of human evolution was attained.

In the period of climatic changes of Pleistocene time the form of the land and distribution of water of the European region also varied much. Particularly in and near the second and third interglacial stages the British Isles and Iceland seem to have been connected with the mainland in the region of France and Belgium; the North Sea was dry, and land extended across from Scandinavia to England. During this period, the boundaries of the sea were in general moved farther out along the borders of the continent than at the present time. There seems also to have been land connection between Spain and northern Africa and between Africa and Italy.

During this period, we find not alone the climatic and geographic conditions subject to modification, but the whole scheme of animal and plant life shifted greatly from stage to stage. As would be expected, during the cold periods waves of migration swept across the continent of Europe from the north, and the Arctic animals extended their range to the lower lands; while during the stages of warm climate southern life reached north to England and middle Europe. Not only was the life shifting through migration of climatic zones, but great groups of species in many divisions of the animal and plant world disappeared, giving place to forms not known in previous time. These in turn became extinct and were largely replaced by new types before the beginning of the present geologic day.

DEPOSITS CONTAINING REMAINS OF LATER PLEISTOCENE MAN IN EUROPE

The geologic record of Pleistocene time out of which we read our human history is obtained from a great variety of evidences, including the accumulation of deposits in seas, lakes, rivers, and upon the land. It is read also from physiographic records shown in the sculpturing of land forms by wind, water, and ice; and in the history of a continuously changing living world, both plant and animal. The sequence of deposits in which entombed organisms have been discovered is complicated and difficult to read. It is moreover not the same record



FIGS. 2 TO 5. CAVE DWELLINGS IN THE VEZERE VALLEY, FRANCE. Fig. 2, Cave adapted for modern home. Fig. 3, Laugerie Haute, a modern dwelling on the site of cave deposits representing the stage of Cro-Magnon man. Fig. 4, Cave at Le Moustier, with deposits of Neanderthal stage. Fig. 5, Floor of Le Moustier covered with flaked flints.

in all localities. Correlations or comparisons between widely separated regions are made with difficulty. It is, nevertheless, true that with the combined use of all known agencies, includ-

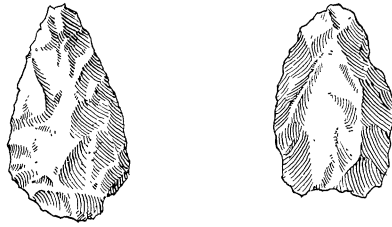
ing the thermometer of climate in glacial history and the record of evolution shown in plants and animals, it has been possible through what amounts to international cooperation to work out a history with some degree of satisfaction.

The human remains of greatest significance in Europe have been found in deposits of two kinds, one consisting of stream accumulations of clay, sand, and gravel; the other the piling up of earth, gravel, sand, and stalagmite deposits in caves.

The relative age of stream deposits, and of their entombed remains, may be determined by the sequence of layers resting one upon another in a single area; or may be indicated by a succession of terrace deposits representing remnants of accumulated strata left stranded in the cutting of a valley. In general, we may not expect the best records of man to be found in formations made by streams. Although traces of skeletons are met occasionally, the destructive action of a stream is generally pronounced. Remains of implements, especially those of stone, being more resistant than skeletons, are better known in stream deposits.

The most important source of human relics of Pleistocene time is found in the numerous caves of limestone formations in western Europe. Caverns have always been places of abode for many groups of higher animals, furnishing as they do shelter from the weather and protection against enemies. Caves have been unusually significant in study of the life of early periods because they have served as concentration points for the remains not merely of their owners, but of the whole range of other animals supplying food from the surrounding country. Cave deposits are also of exceptional significance for the reason that in limestone regions, lime-burdened water dripping from the roof upon bones or other relics has often encased them with a calcareous or stalagmitic covering.

Man like other creatures seems early to have learned the advantage of cavern life. In the cave he also accumulated heaps of bones representing the animals upon which he preyed, and his bones like those of other animals were entombed in earth, clay, gravel, and stalagmite deposits in the floor of the room that was once his home. In our search for evidence concerning the history of man in the long period through which he worked his way up to domination of the natural world, no information has been found to exceed in interest the records held for ages in safe keeping in the caves. A story of the beginning history of our race comes to us from these sources filled with the thrill of adventure, and showing always the upward striving of becoming man.



FIGS. 6 AND 7. FLAKED FLINTS OF THE RIVER DRIFT STAGE. Adapted from Reinach.

RIVER DRIFT MAN

In the divisions of the geologic record succeeding those from which we have obtained *Pithecanthropus* and the Heidelberg man there are several stages at which relics apparently representing human handwork have been found without accompanying skeletal evidence of man himself. Such remains are the flaked flints of Chellean and Acheulean types discovered especially in stream deposits of the Somme Valley in northern France and in the south of England. These objects are found in deposits evidently younger than those from which the earlier eoliths are obtained and show clear evidence of purposeful shaping. They are flaked in such manner as to leave no doubt concerning the influence of an intelligent creature like man in their forming. They were evidently produced by beings of the human type inhabiting Europe subsequent to the time of Heidelberg man and before the stage of the typical Neanderthal race.

NEANDERTHAL MAN

Following the stage of Heidelberg man the earliest human relics of which we have evidence in skeletal characters are those representing the Neanderthal race. This type is now well known by skulls and other skeletal parts from numerous cave deposits of western Europe. With these remains there have been found also abundant traces of implements and of the contemporaneous animal life of this period. The materials available have made possible a very satisfactory interpretation of the physical characteristics, industry, mentality, and environment of the race.

The Neanderthal type has been best known by a now famous skeleton obtained in 1856 in a cave near Düsseldorf. Other specimens of similar type are the Gibraltar, Spy, Chapelle-aux-Saints, and Le Moustier remains, together giving full opportunity for interpretation of the characters of this remarkable race. All of these skeletons represent beings distinctly human, and with moderately large brains, but possessing exceedingly

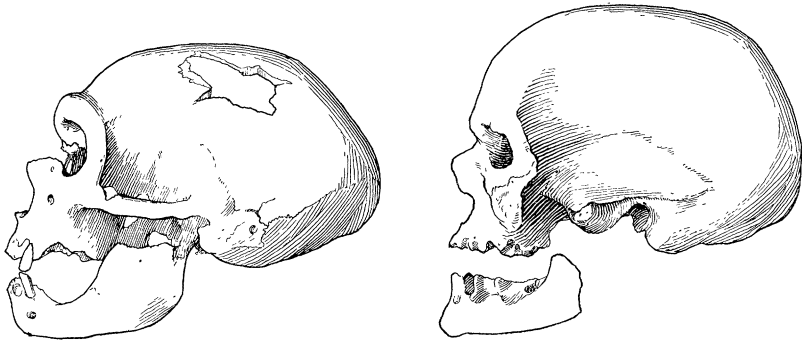


FIG. 8. SKULL OF NEANDERTHAL TYPE FROM CHAPELLE-AUX-SAINTS, FRANCE, $\times \frac{1}{2}$.
Adapted from Boule.

FIG. 9. SKULL OF CRO-MAGNON MAN FROM LES EYZIES, FRANCE, $\times \frac{1}{2}$.

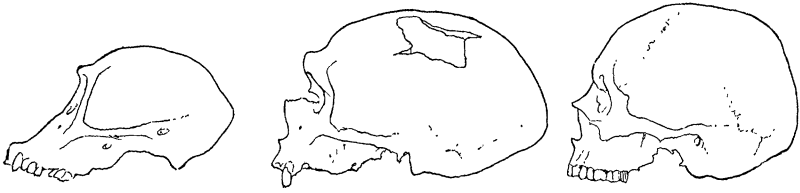
low and generally depressed skulls with extraordinarily large ridges over the eyes.

Associated with the remains of Neanderthal man in the cave deposits at various localities there have been found great quantities of flaked flints which were evidently the characteristic implements utilized by this race. In the famous cavern at Le Moustier enormous numbers of flints are known, of which some are discarded implements and others are probably the byproducts of implement manufacture. They all indicate a stage of development in which the flaking is sufficiently advanced to give a clean, sharp cutting edge undoubtedly used for a wide variety of purposes.

In the same deposits with the remains of Neanderthal man, and with the relics of his culture, there are found abundant skeletal parts of the animals of the surrounding region which provided food and probably clothing. Other animal remains found in the caves may have been accumulated by carnivorous mammals occupying these shelters in intervals between periods of human habitation. From the evidence available we know



FIGS. 10 AND 11. FLAKED FLINTS FROM FLOOR OF THE CAVERN OF LE MOUSTIER, $\times \frac{1}{2}$.



FIGS. 12, 13 AND 14. COMPARISON OF SKULL OF NEANDERTHAL MAN WITH A CHIMPANZEE, TO THE LEFT, AND A MODERN MAN, TO THE RIGHT.

that Neanderthal man was associated with the reindeer, woolly rhinoceros, woolly mammoth, horse, stag, giant deer, bison, cave bear, cave lion, and cave hyena. A large percentage of these animals are now extinct and are characteristic of the later Pleistocene of Europe.

In many respects the Neanderthal type presents the most striking illustration of connection between the later stages of human evolution and the history of mammalian groups which in their development trend toward man in the distinctly pre-recent portion of the record of life. The history of the Neanderthals lies well within a geological period distinctly separated from the present, the environment of this man was physically and biologically a world differing from the present, and the man himself differed markedly from any existing race. In very many ways the Neanderthals express that remoteness of time, difference of surroundings, distinct difference of physical char-



FIG. 15. RESTORATION OF NEANDERTHAL MAN. Drawn by Frieda Lueddemann, under the direction of the author.

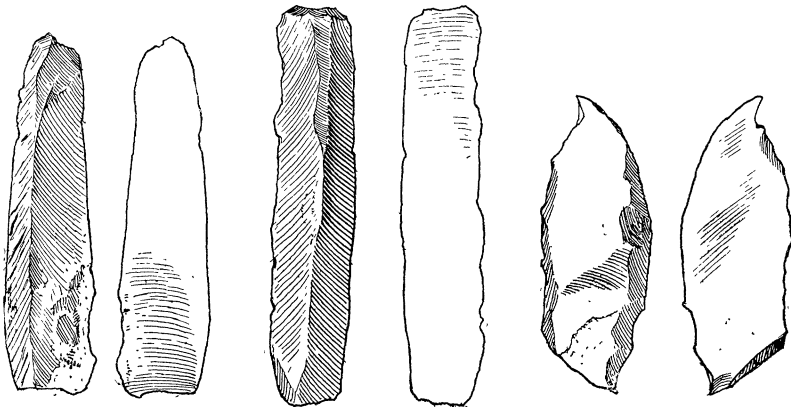
acteristics, inferior level of industry, and limitation of mental development, which one might expect to find somewhere between *Pithecanthropus* and modern races if the existing human group represents progressive development out of a more ancient and less human stock.

CRO-MAGNON MAN

At numerous localities in western Europe we find abundant evidence that a type of human being differing widely from the typical Neanderthals occupied this region between the time of Neanderthal man and the present epoch. These remains are found in cave deposits, and like those of the Neanderthals are associated with abundant implements and with the remains of a wide variety of animals which as their contemporaries furnished food and clothing.

The history of this later type is known in several stages, of which one of the most important is that represented by the famous Station of La Madeleine, only a short distance from Le Moustier on the Vezere River in the French province of Dordogne. The skeletal remains of this race generally represent individuals of large size, with skulls corresponding in outline to highly developed types of the present period. The brain case, like that of modern man, has a large content, and the form of the brain corresponds to that of the vigorous mental types of the present day.

Judging from physical characters alone one could not avoid the conclusion that this Cro-Magnon type represents a form of man skilled in thinking and in the expression of thought through action. It is, therefore, not surprising to find associated with this race a wide range of beautifully formed implements shaped



FIGS. 16, 17 AND 18. TYPICAL MAGDALENIAN FLAKED FLINTS FROM THE STATION OF LA MADELEINE, FRANCE, $\times \frac{1}{2}$.

from stone and from the bones of animals hunted. The stone implements show an advance in the art of chipping or flaking developed in various forms, some delicately flaked, others giving long clean-cut lines and sharp edges. Implements of bone and antler are abundant and rival in their form and ornamentation the beautiful carvings of modern Eskimo. We find also on implements and on fragments of bone and antler extraordinary expressions of an artistic instinct represented in drawings of the contemporary animals and even of people. These illustrations show us the reindeer, the mammoth, and the bison, as living creatures fully known to Cro-Magnon man and pictured by him in characteristic attitudes of action. Even more remarkable if possible are the wonderful series of drawings and paintings left by this race on the walls of many caves which were evidently not habitations but served some mysterious purpose not yet fully understood.

The remains of animals associated with the Cro-Magnons include reindeer in abundance, horses, the woolly elephant, woolly rhinoceros, cave bear, lion, and many other creatures representing a fauna in large part extinct, and of which the

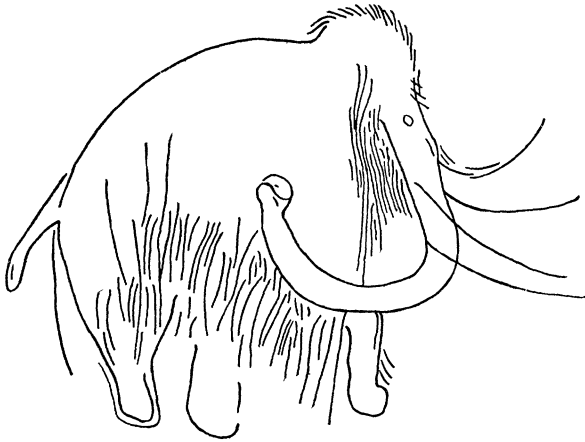


FIG. 19. REPRESENTATION OF THE WOOLLY ELEPHANT, DRAWN ON THE WALL OF THE CAVE OF COMBARELLES, LES EYZIES, FRANCE. Adapted from Capitan and Breuil.

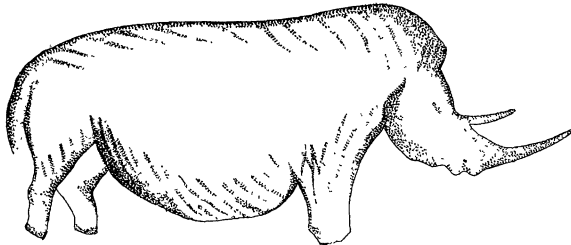


FIG. 20. PAINTING OF THE WOOLLY RHINOCEROS ON THE WALL OF THE CAVE OF FONT-DE-GAUME, LES EYZIES, FRANCE. Adapted from Capitan and Breuil.



FIG. 21. RESTORATION OF CRO-MAGNON MAN. Drawn by Frieda Lueddemann under the direction of the author.

surviving types are known principally from regions outside western Europe.

In physical development, and apparently in mentality, the Cro-Magnons approached closely the characteristics of modern man. This race represents in western Europe the beginning of modern life taking its origin in ancient times. The Neanderthals go far in physical characters, in mentality, and in environmental setting to bridge the gap between modern man and the earliest humans. The Cro-Magnons show us that even the modern cast of physical development is rooted deeply in the remoteness of an early geologic day.

SIGNIFICANCE OF DATA BEARING UPON THE PROBLEM OF HUMAN ORIGIN

Passing in review the stages in evolution of man, it is desirable to note once more the evidence of geological succession of the four human types already discussed, and with this to state that all four were present on the earth before the beginning of the present period. The proof of their antiquity seems especially striking when we consider that between the time of appearance of the third or Neanderthal type and the present day events of great geological and biological significance profoundly changed the face of nature, and that after the Neander-

thals had become established in this region a period of fifty thousand to two hundred thousand years probably elapsed before the modern races became dominant.

It should be noted again that remains of the later stages, including Neanderthal, although apparently absent from the New World, seem widely distributed over Europe, Asia, and Africa. The first two stages, represented by *Pithecanthropus* and Heidelberg man, are known by single occurrences, and the one generally assumed to be the earlier is situated in a region known to be an area of evolution of the anthropoid group.

We have also seen that the series shows us, in passing backward through it, a reduction in brain capacity, increase in the prominence of the face, and a general taking on of anthropoid characters, until the earliest form is recognized as unquestionably of all human types the one standing nearest to the apes, and yet apparently distinguished from anthropoids by its specialized human limbs.

While the evidence is incomplete, the record as it stands agrees down to extraordinary detail with the expectation which one might have of early human history based upon the view that man, while a derivative of the anthropoid group, is now widely separated from all simian types, and has presumably required long ages in which to reach his present stage of differentiation away from the primitive stock.

The earliest occurrences are at the geographic point where we would expect to find them. The earliest types represent approximately the stages of evolution that the paleontologist would anticipate discovering in the strata from which they have been recovered. The later history shows a gradual modification at a rate corresponding in general to that seen in history of other groups of mammals. We note also that the family seems to spread itself gradually over the world, and as nearly as we can determine, with this wider distribution there begins the differentiation into distinct types or species characteristic of geographic provinces.

In a word, human history, so far as the development of physical or biological man is concerned, indicates that our origin is comparable to that of other organic groups, and that we are apparently an outgrowth from the mammal world subject to the same laws of evolution and differentiation as are expressed in myriads of other organic types. The existing races of man represent the morphological and geographical expression of this evolutionary history. Their characteristics are clearly the result of hundreds of thousands of years of differentiation. The

stamp that is put upon each type is the product of extraordinarily complicated influences in which inheritance and environment are essential elements. They are not fleeting impressions, but have significance comparable to that definiteness in organic type which leads us to expect the rose to beget roses, and lions to be the offspring of lions.

As was noted in the introduction to the first lecture, students of biological aspects of the human problem have recently called particular attention to the importance of race as weighing definitely in consideration of many world problems, along with the factors based upon differentiation of peoples according to linguistic stocks, ethnologic relationships, and social organization. This is not interpreted to mean that great significance does not attach to the group influence in peoples organized according to ethnologic characters, or by reason of the effect of language, or through many other causes. It does mean that factors of fundamental significance, resting upon basal characteristics of human nature, brought out in our long history, and represented now in race, have perhaps received less consideration than is their due. It means not only that a clear view of the human situation must present a picture showing the common generalized characters represented in practically all human types and individuals, but that with these we must see also the length and breadth, the height and depth of human differences. Unless this view is taken we shall fall short of the interpretation of humanity needed in order to give to every group, as well as to every individual, that full freedom to develop *its own peculiar talent*, and to grow into the fullest usefulness which we assume to be the natural right of all.

And finally, the whole trend of history within the chapter just read from ancient records exhibits without question a definite progressive movement of the human type. This is expressed in physical capacity for greater breadth of comprehension, and in wider range of activity and occupation given by coordination of the brain and hand as also of the brain and tongue. Man of the present day may read his story back to that early stage in which he first sees himself distinguished from the beast. He sees the beast made to a man-like beast and then a man. Perhaps to you the student of this ancient life has seemed to look upon a passing scene which might well have been left unknown—and yet to those who read what he who runs may see, the present world is brighter for the view—the future built upon the upward striving of the past must see the best there is in life at length prevail.